^{7}Be BREAKUP ON HEAVY AND LIGHT TARGETS

N. C. Summers and F. M. Nunes
NSCL and Department of Physics and Astronomy, MSU, East Lansing MI 48824, USA

At present, the capture rate ^{3}He(α,γ)^{7}Be is one of the most uncertain in the *pp* chain, with implication to the solar neutrinos. At the low energies of astrophysical relevance, these rates are exceptionally hard to measure directly. Consequently, indirect methods using the inverse breakup reaction have been considered. These are: i) The Coulomb dissociation method proposes the measurement of radiative capture rates from breakup data on heavy targets [1], ii) The Asymptotic Normalization Coefficient (ANC) method proposes the measurement of the capture rate from transfer reactions [2] or breakup reactions [3].

The uncertainties on the direct capture measurements for the ^{3}He(α,γ)^{7}Be reaction has motivated two very recent breakup experiments: one at the NSCL, measured the ^{7}Be breakup on ^{208}Pb at 100 MeV/nucleon, and the other at the Cyclotron Lab in Texas A & M, which used a ^{7}Be 25 MeV/nucleon beam on a ^{12}C target.

We present all-order quantum mechanical calculations [4] for these two experiments using the method of Continuum Discretized Coupled Channels (CDCC) [5]. We discuss the issues concerning the extraction of the astrophysical $S_{34}(0)$ from the breakup data using the methods of Coulomb dissociation and the Asymptotic Normalization Coefficients.

It is often assumed that by measuring the breakup on heavy targets at forward angles, the cross section can be measured free from nuclear effects. We show that ^{7}Be breakup at forward angles is actually dominated by nuclear breakup (diffraction dissociation). We discuss how by careful kinematic selection, regions where Coulomb breakup is the dominant mechanism can be chosen.

The extraction of the S_{34} using the ANC method requires a peripheral reaction. We show that contributions from the nuclear interior must be taken into consideration.

* This work has been supported by the National Superconducting Cyclotron Laboratory at Michigan State University

[1] G. Baur and C.A. Bertulani, Nucl. Phys. **A458**, 188 (1986).
[2] H. M. Xu, C. A. Gagliardi, R. E. Tribble, A. M. Mukhamedzhanov, and N. K. Timofeyuk, Phys. Rev. Lett. **73**, 2027 (1994).
[3] L. Trache, F. Carstoiu, C. A. Gagliardi, and R. E. Tribble, Phys. Rev. Lett. **87**, 271102 (2001).
[4] N.C. Summers and F.M. Nunes, Phys. Rev. C (2004) *submitted.*
[5] Y. Sakuragi, M. Yahiro, and M. Kamimura, Prog. Theor. Phys. Suppl. **89**, 136 (1986).